Work Assignment No. 6
MTA Agreement No. 15099-0300

Utica Avenue Transit Improvements Study

Task 2 Deliverable 4: New Lots Av Terminal

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1 Executive Summary

New Lots Av Terminal is the terminus for the elevated New Lots Av Line and is served by the 3 during the day and the 4 overnight. The terminal has two tracks surrounding a center-island platform, with a mezzanine below and staircases leading down to the street. South of the station is the Livonia Maintenance Facility and Storage Yard (hereafter, Livonia Yard), which maintains the trainsets assigned to the 3 and provides overnight trainset storage.

As part of the Utica Avenue Transit Improvements Study (hereafter, Utica Avenue Study), the New Lots Av Terminal is under consideration as one of the five stand-alone study locations where operational and capacity improvements could be made to the existing subway system. The objective of this report was to determine viable alternative infrastructure modifications that could improve operations into and out of the New Lots Av Terminal, considering construction costs, constructability, and potential impacts to the community and subway service. The other four locations under consideration are Nostrand Junction, Flatbush Av Terminal, Crown Heights-Utica Av Station, and Livonia and Linden Yards.

Practical options to improve operations at New Lots Av Terminal are limited given right-of-way constraints, the existing station configuration, track gradient changes, potential community impacts, impacts to Livonia Yard, and the requirement to maintain subway service during construction. Two viable improvements were identified:

[1] By NYCT convention, a revenue track is designated either northbound or southbound according to the primary direction of travel on that track with respect to Manhattan. Any track that enters Manhattan from the Bronx or Queens heads southbound into Manhattan; any track entering Manhattan from Brooklyn goes northbound into Manhattan.

[2] Another option suggested by NYCT during an Infrastructure Working Group meeting would be to upgrade the existing switches to tangential geometry, which could provide modest improvements without the need to replace the whole crossover.

[3] The estimates of capital cost and construction duration prepared throughout the Utica Ave Study conservatively assumed a design-bid-build contracting method. A number of potential efficiencies could be realized through a design-build contracting method, including the prospect of shortening project schedules. The potential reduction in the overall duration of design and construction could, in turn, lead to a reduction in the capital cost estimate for a given project, as escalation is determined based on the midpoint of construction. Additionally, the owner could realize potential cost savings in the form of reduced administrative and management costs (due to improved coordination between the design and construction work) as well as reduced construction costs arising from Alternative Technical Concepts that can leverage the expertise and experience of each design-build proposer. Overall, as noted in the Metropolitan Transportation Authority (MTA) 2020-2024 Capital Program, the use of a design-build contracting method can "rebalance the risk equation between the MTA and its contractors." Section 1264 of the New York Public Authorities Law calls for "the use of design-build contracting on all projects over twenty-five million dollars in cost except where a waiver is granted by the New York state budget director pursuant to a request in writing from the metropolitan transportation authority." As such, the use of design-build contracting—and the specific efficiencies that could be realized—should be revisited for any concept that is advanced beyond this study.

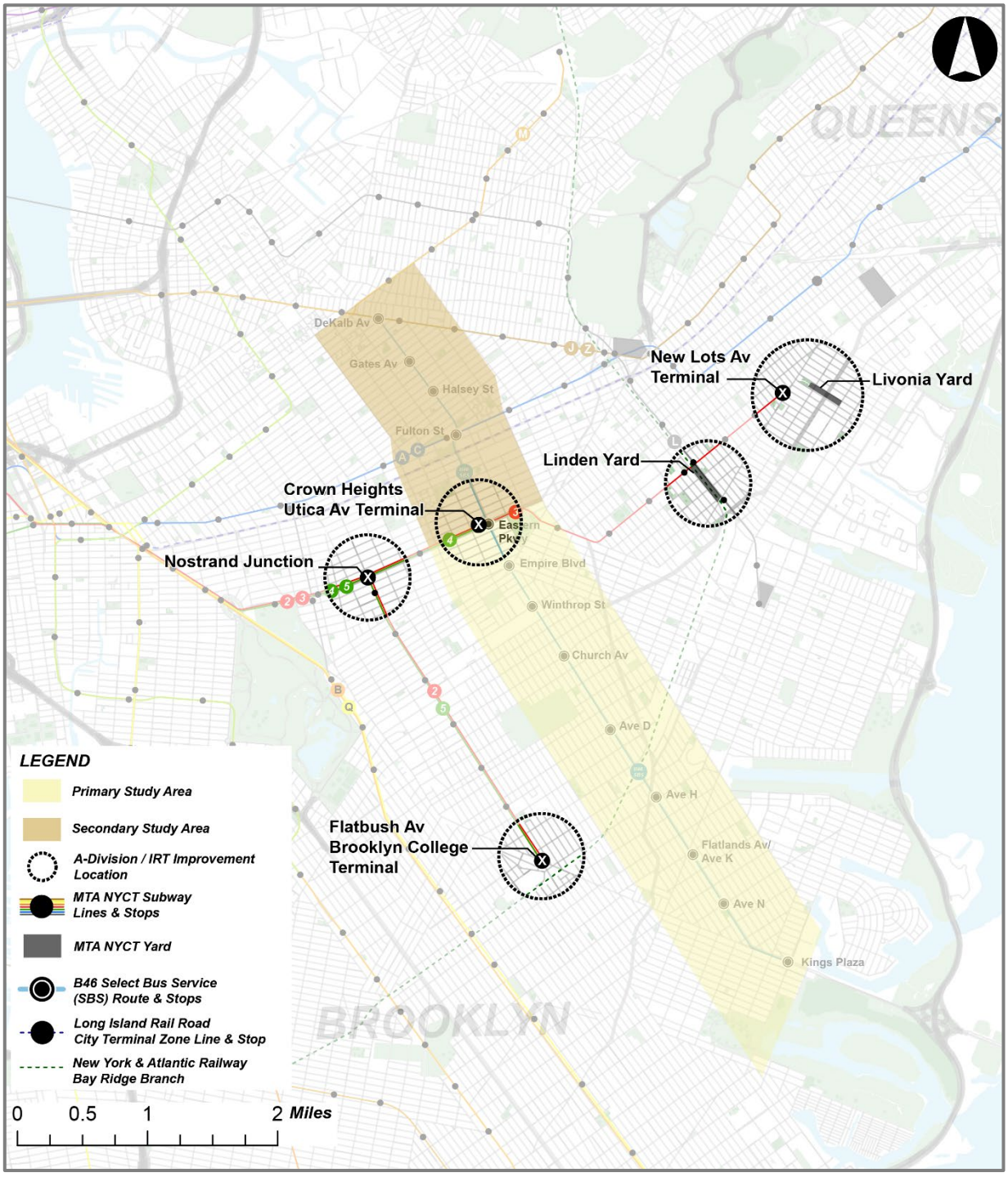
2 Introduction

This report, developed as part of the Utica Avenue Transit Improvements Study (hereafter, Utica Avenue Study), recommends possible infrastructure improvements at New Lots Av Terminal. New Lots Av Terminal is one of the five stand-alone study locations where operational and capacity improvements could be made to the existing subway system, complementary to but independent of any potential transit improvements along the Utica Avenue corridor. The intent of the five study locations is to identify methods to increase the existing A-Division capacity and operational flexibility in eastern Brooklyn and offer a range of solutions to alleviate existing constrained conditions pertaining to train operation bottlenecks and shortage of train storage or lay-up capability. The other four locations are Nostrand Junction, Flatbush Av Terminal, Crown Heights-Utica Av Station (hereafter, Utica Av Station), and Livonia and Linden Yards (Figure 1).

The objective of this report is to determine viable alternative infrastructure modifications that could improve operations into and out of the New Lots Av Terminal within the context of limited potential options due to the existing elevated structure layout, right-of-way constraints, potential community impacts, and potential impacts to continuing operations at nearby Livonia Yard. A separate report addressing potential improvements to Livonia and Linden Yards will assess the need for additional yard access that might include new lead tracks extending to a new connection with the New Lots Av Line tracks subway north of New Lots Av Terminal.

The principal capacity constraint of New Lots Av Terminal is the #6 universal crossover located north of the station, which has 10 MPH diverging speed. The following sections of this report discuss existing conditions and operational constraints as well as proposed infrastructure improvements to address these constraints.

Figure 1: Study Area and A-Division Improvement Locations for the Utica Avenue Transit Improvements Study



Source: Utica Ave Study

3 Existing Conditions and Constraints

3.1 EXISTING INFRASTRUCTURE AND OPERATIONS

New Lots Av Terminal (Figure 2) is the last station on the elevated New Lots Av Line, part of the A-Division in Eastern Brooklyn. The New Lots Av Line is elevated between subway south of Utica Av Station and New Lots Av Terminal, which consists of a center-island platform straddled by two tracks, one northbound[4] (Track 4) and one southbound (Track 1). The station is served by the 3 throughout the day and evenings and by the 4 during overnight hours, when the 3 does not operate south of the Times Square-42nd Street Station.

Figure 2: New Lots Av Terminal Site Plan

Source: WSP, adapted from Google Earth

New Lots Av Terminal is situated above the intersection of Livonia Avenue, Ashford Street, and New Lots Avenue in East New York. Two staircases on either side of Livonia Avenue at Ashford Street provide access up to the station mezzanine. The fare control area is within the mezzanine, which is at the subway south end of the station, above street level but below the platform level.

Subway north of the station, a #6 universal crossover5 enables southbound trains arriving on Track 1 to berth at the station on either Track 1 or Track 4. Subsequent southbound trains can berth at the station on whichever track is not occupied. When departing the station in passenger service, northbound trains on Track 1 use the crossover to access northbound Track 4 or to depart the station using Track 4 directly.

The existing #6 universal crossover is located on a vertical curve in the track profile. Typically, crossovers on vertical or horizontal curves are avoided. This is because switches on vertical curves are liable to shift out of adjustment, so that they do not to lock effectively and the interlocking signal system "fails." Special trackwork on vertical curves is also subject to increased rail and wheel wear, thus requiring increased maintenance to both the tracks and railcars. However, as per MW-1 (NYCT Track Design Guidelines) Section 205.5(G), crossovers are permitted on vertical curves that do not exceed a 1% rate of change (i.e., a 1% increase in

[4] By NYCT convention, a revenue track is designated either northbound or southbound according to the primary direction of travel on that track with respect to Manhattan. Any track that enters Manhattan from the Bronx or Queens heads southbound into Manhattan; any track entering Manhattan from Brooklyn goes northbound into Manhattan.

[5] Appendix A contains a glossary of terms.

grade for every 100 feet). Heading southbound towards New Lots Av Terminal, the vertical profile of the track transitions from a descending 3% grade to a level grade (0%) at a rate of change within the permissible 1% limit. Thus, the crossover meets current NYCT design guidelines.

To the subway south of the station, Tracks 1 and 4 serve as yard lead tracks that continue subway south and curve into Livonia Yard. Two additional diamond crossovers, one immediately subway south of New Lots Av Terminal and the other just subway north of the Livonia Yard throat, allow trains to switch between Tracks 1 and 4 while entering or departing the storage yard. The diamond crossover immediately subway south of the station is not standard. It was custom-built because the track centers are not parallel, getting closer together as they enter the curve into Livonia Yard.

Livonia Yard is subway south of New Lots Av Terminal. Livonia Yard primarily maintains and stores the trainsets that are assigned to the 3, but also stores a small quantity of 2, 4, and 5 trainsets. Livonia Yard's location beyond the last passenger station on the line enables simple and direct train "put-ins" and "layups" without the need to deadhead trains over active passenger service tracks. During the service ramp-up to the AM peak period, trains depart Livonia Yard via the northbound yard lead track and pull directly into the northbound track at New Lots Av Terminal. Similarly, when trains are removed from service during the off-peak periods, revenue service trains discharge passengers at New Lots Av Terminal, NYCT staff walk through the trains to ensure no passengers remain onboard, and then the trains directly enter Livonia Yard using the southbound yard lead track.

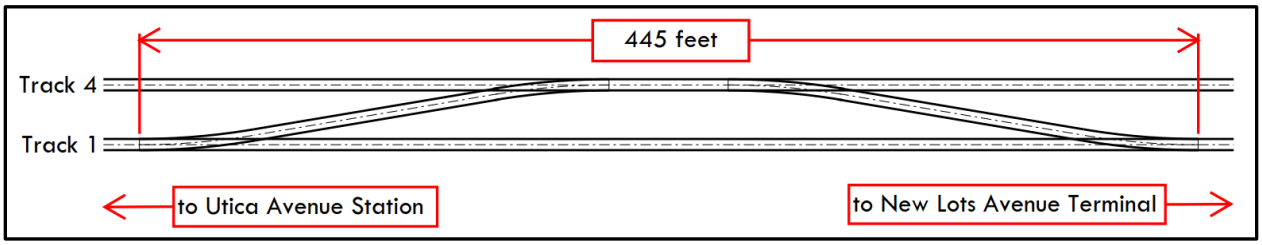
The yard lead tracks also serve another important function by permitting trainsets located in the storage yard to drill into the maintenance shop. The distance between the crossovers is 550 feet, which is just long enough to relay a full-length A-Division trainset without affecting other trains dwelling at the station. Non-revenue trains leave the storage yard, briefly stop on the tail tracks between the crossovers, and then reverse direction back into the maintenance shop, or vice versa.

3.2 EXISTING OPERATIONAL CONSTRAINTS

The existing #6 American Railway Engineering and Maintenance-of-Way Association (hereafter, AREMA) universal crossover (Figure 3) limits operational capacity at New Lots Av Terminal. The speed limit of a diverging train on this crossover is 10 MPH and that limit applies for the full length of the footprint of the universal crossover because there are no intermediate signals within the interlocking. As such, both northbound and southbound trains are blocked for the full time that a diverging move train in either direction occupies the interlocking. Furthermore, by the time the last car of a southbound diverging train exits the interlocking, nearly a third of the train is already into the Track 4 platform, so the train operator would not be likely to increase speed before quickly applying the brakes to come to a full stop at the station platform. Effectively, a diverging southbound train is limited to 10 MPH from when the front of the train enters the interlocking until it stops on the platform. Similarly, northbound trains starting from the Track 1 platform and making a diverging crossover move onto Track 4 must proceed at 10 MPH until the rear of the train clears the interlocking. These factors significantly increase the time needed for a cycle of four trains to enter/depart New Lots Av Terminal, thereby constraining the maximum number of trains per hour that can be operated.

A similar operating capacity constraint occurs on the yard lead track crossovers, but because this is non-revenue track the overall operational impact is less consequential.

Figure 3: Existing #6 AREMA Universal Crossover



Source: WSP

Another capacity constraint at New Lots Av Terminal is related to the proximity to Livonia Yard. Specifically, in the mornings while the two New Lots Av Terminal tracks are processing peak period turnback operations, adequate track slots must be provided for "put-ins" from Livonia Yard that enter revenue service at Utica Av Station. Some of these deadhead trips are "off-schedule" trips supporting service on the 2, 4, and 5 trains (i.e., these trips are not listed in the public timetables), but they still consume track slot capacity in route to Utica Av. However, with the introduction of Communication-Based Train Control (CBTC) in the No Build condition (see Section 4), the put-ins from Livonia Yard into New Lots Av Terminal would not pose a constraining "bottleneck" to operations at New Lots Av during peak service.

4 No Build Condition for New Lots Av Terminal

4.1 SITE-SPECIFIC CHANGES

Absent this study, no site-specific changes are planned, programmed, or committed at New Lots Av Terminal through the 2035 horizon year.[6] Thus, the existing New Lots Av Terminal plus the addition of Communication-Based Train Control (CBTC), as discussed below, constitutes the No Build Alternative at this location.

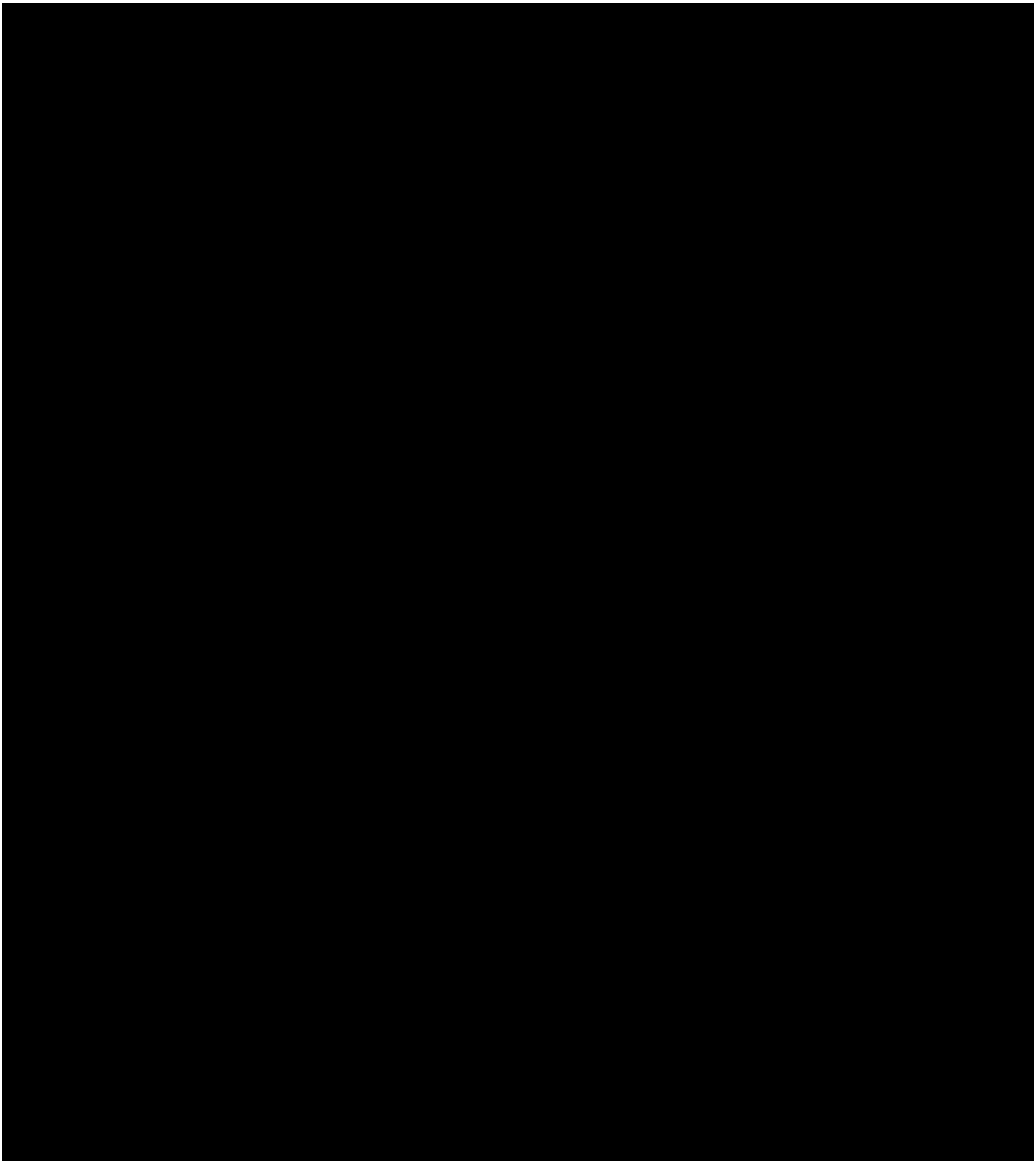
4.2 COMMUNICATIONS-BASED TRAIN CONTROL (CBTC)

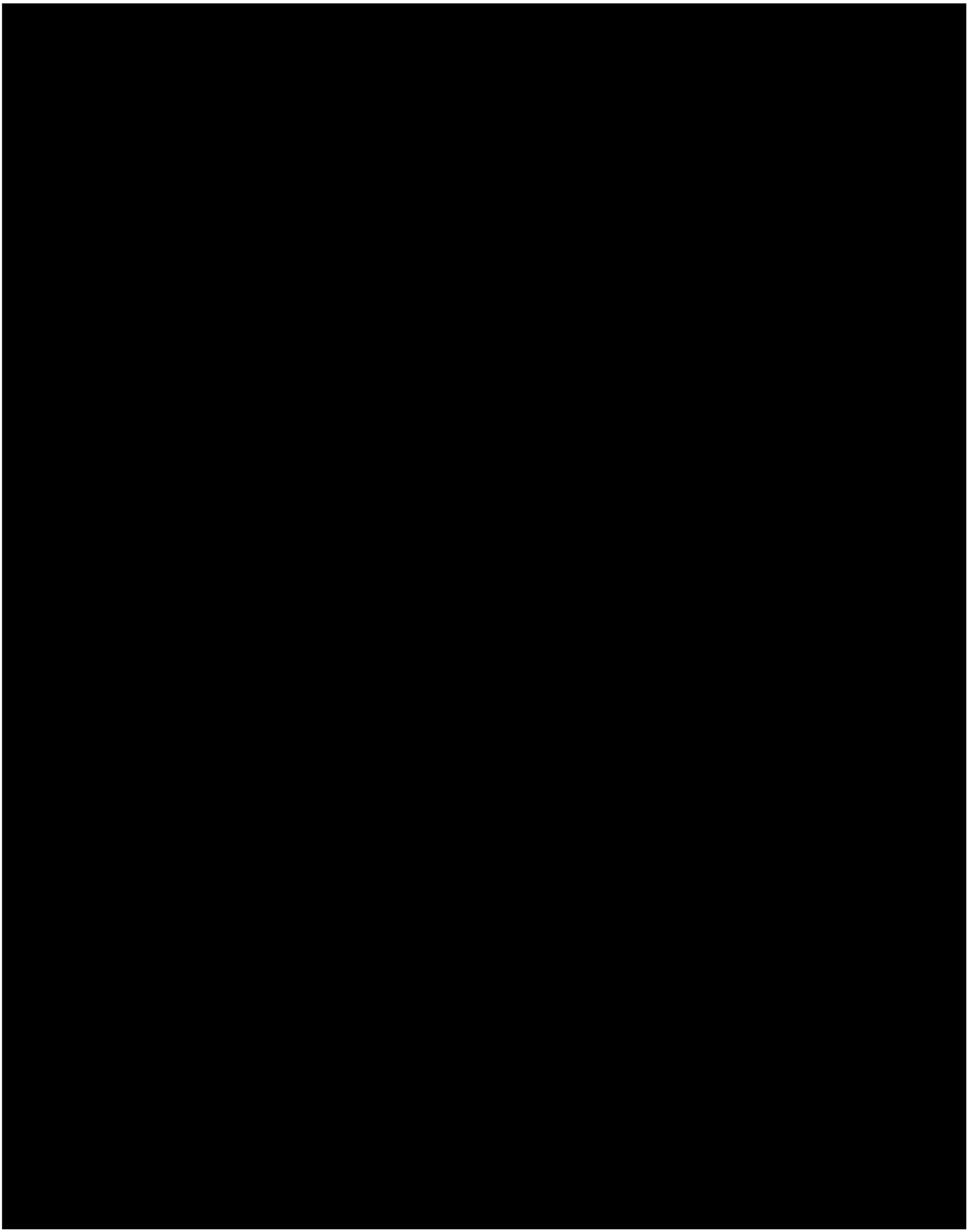
Fast Forward: The Plan to Modernize New York City Transit (hereafter, Fast Forward Plan) is a 10-year look ahead plan that sets forth a vision to reimagine the subway system. A key element of the plan is the installation of CBTC signaling, which has been proposed to replace segments of the existing fixed-block signaling system. CBTC is considered more reliable than fixed-block signaling, offers train dispatchers more accurate train location information, and has the potential to increase the number of trains running on each line because trains can be operated in Automated Train Operation mode, which reduces train performance variability among train operators. CBTC can control trains more precisely, and can dynamically ensure safe separation of trains.

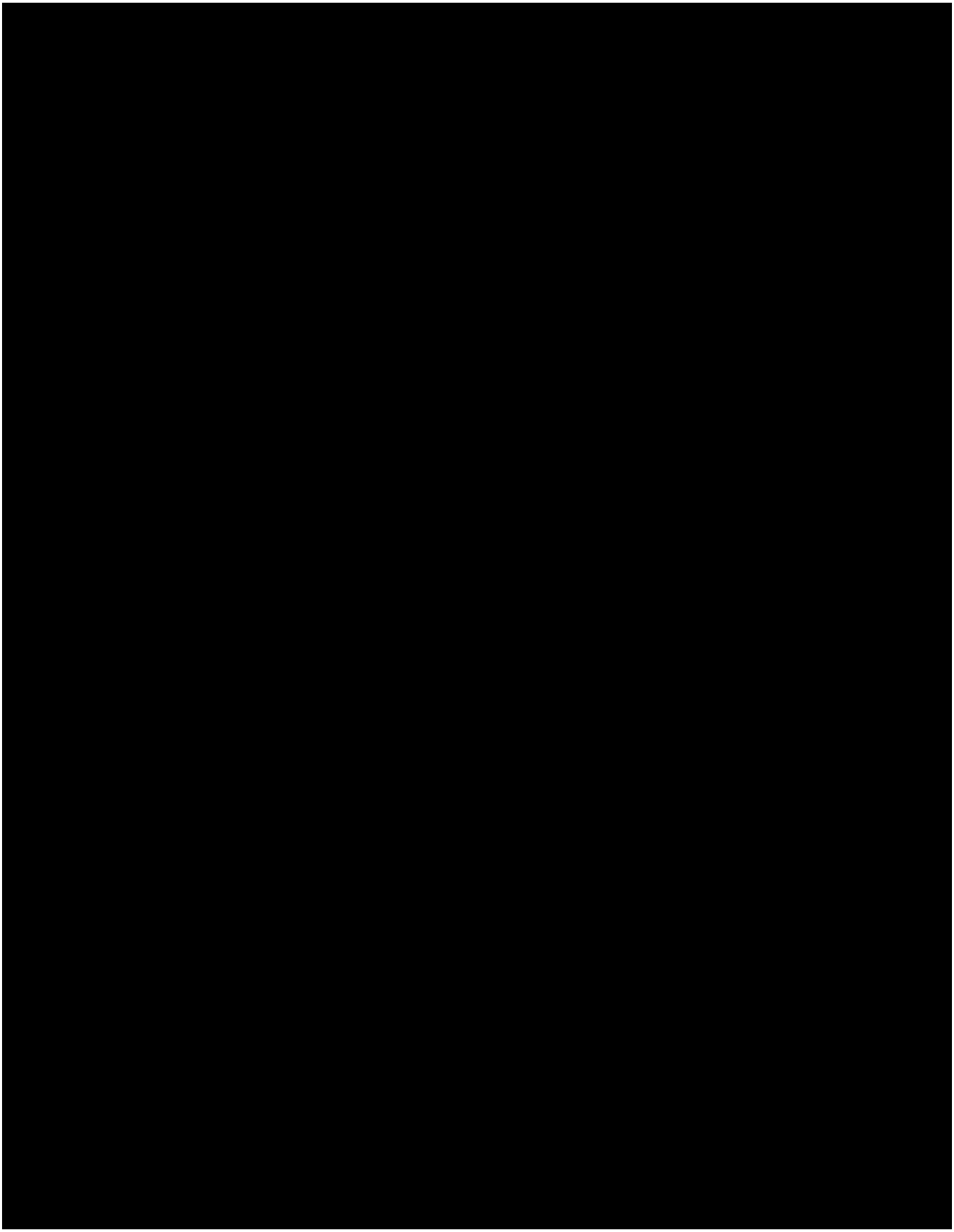
The Fast Forward Plan does not propose to install CBTC on the A-Division Lines east of Nevins Street Station in the first 10 years of plan implementation. However, the NYCT's A-Division Capacity Study currently underway includes train operations simulation analyses with CBTC installed and active throughout the Brooklyn A-Division Lines. Furthermore, NYCT has directed that the service plans and simulations to be performed as part of the Utica Avenue Study should use the A-Division Capacity Study simulation models with CBTC as a basis for evaluation of the Utica Avenue Study improvements packages. As such, the Utica Avenue Study is proceeding with CBTC as part of the No Build Alternative.

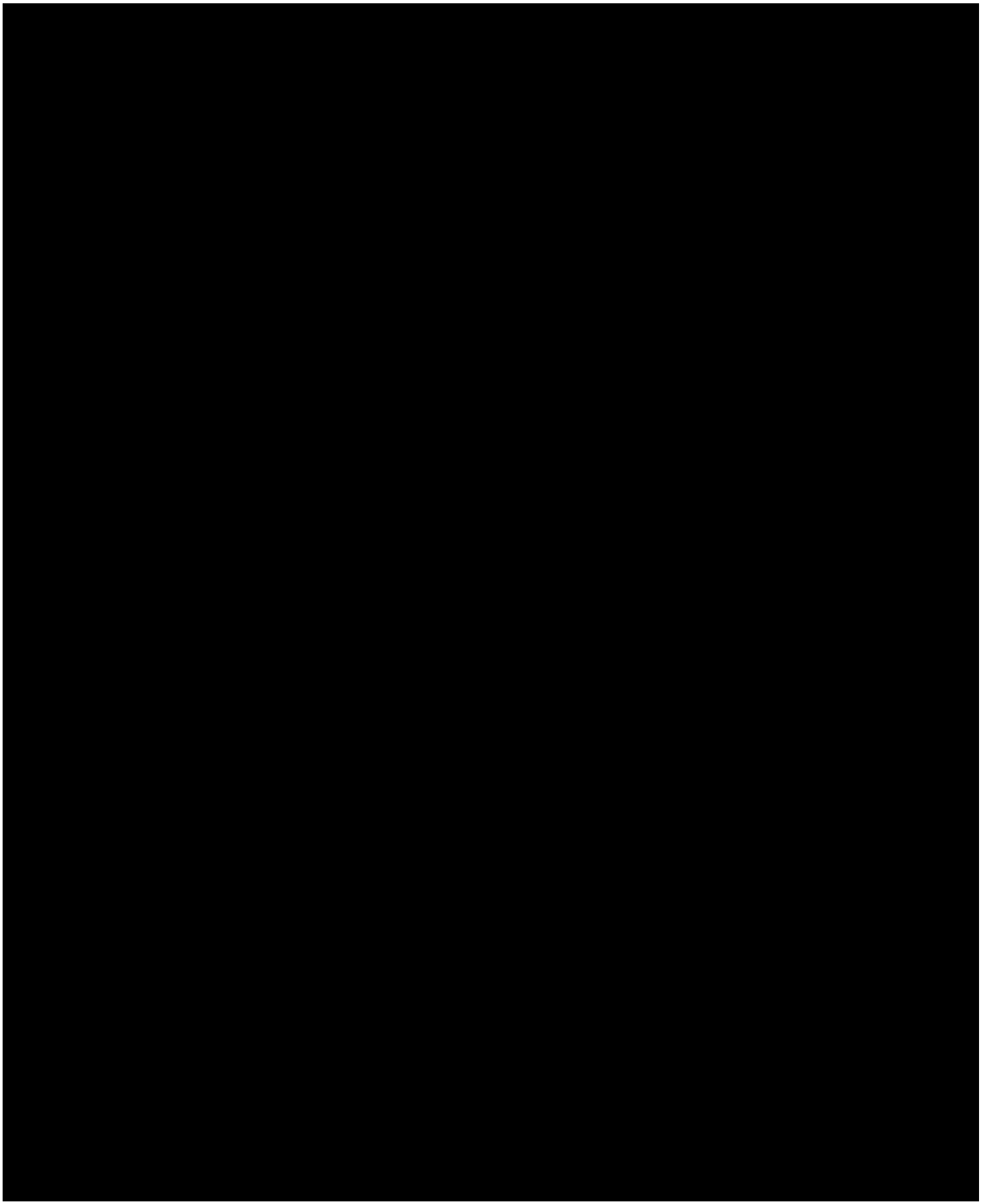
[6] The *MTA Twenty-Year Capital Needs Assessment 2015-2034* identifies the following strategy to "alleviate hotspots," but no improvements are planned, programmed, or committed: "Rebuilding critical subway junctions where lines merge and separate (such as Nostrand Junction on the 2 3 4 5 lines) to maximize train throughput and reduce delays."

5 Potential Infrastructure Improvements

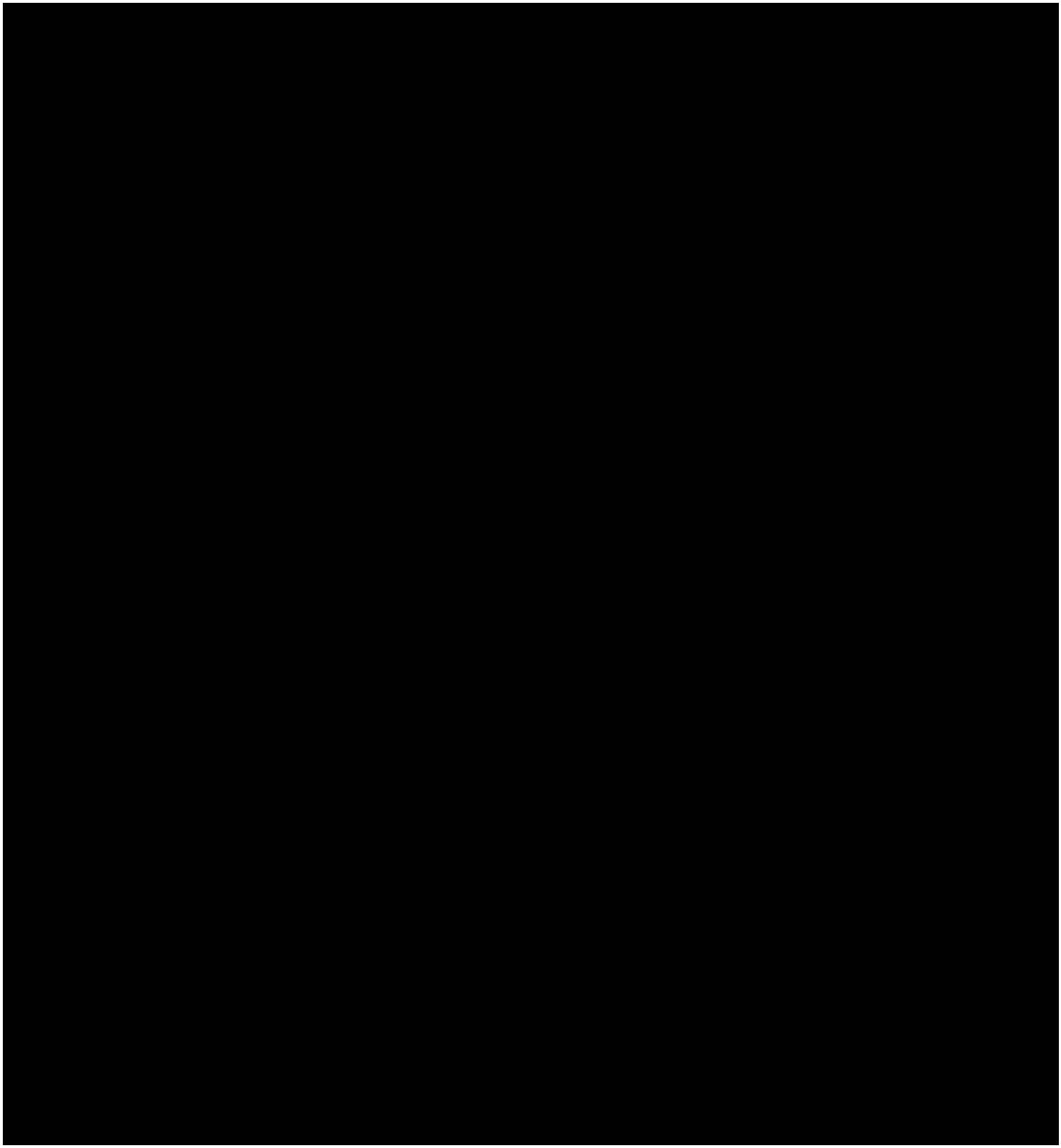








6 Preferred Option Recommendation



7 Conclusion

Practical options to improve operations at New Lots Av Terminal are limited given right-of-way constraints, the existing station configuration, track gradient changes, potential community impacts, impacts to Livonia Yard, and the requirement to maintain subway service while any improvements are being constructed.

[redacted]

As a subsequent step in this study, the Study Team will determine—in coordination with NYCT and the Steering Committee—whether the recommendation contained herein should be included in the Final Investment Packages in Task 5 (including consideration for transit improvements along Utica Ave). Regardless of whether the improvement is included in the Final Investment Packages, it still has independent utility and can be advanced by NYCT beyond this study.

Appendix A – Glossary of Terms

A-Division comprises the original subway lines constructed by the Interborough Rapid Transit Company. A-Division train cars are narrower than those on the B-Division lines, but both divisions have the same track gauge (standard, 4'-8.5").

Communications-Based Train Control (CBTC) is a signaling system that uses telecommunications between the train and the track equipment to keep trains at a safe separation, manage train traffic, and ensure compliance with track speed limits. With CBTC, the exact position of the train is more accurately known than with traditional fixed-block signal systems. Within NYCT, CBTC has been introduced on the Canarsie Line (L train) and the Flushing Line (7 train).

Crossover is an interlocking between parallel tracks to enable trains to move from one track to the other. A Universal Crossover consists of an adjacent pair of crossovers, one with right hand turnouts and one with left hand turnouts, and it provides for a train traveling in either direction on either of the parallel tracks to cross to the parallel track. A Diamond Crossover provides the same crossover capabilities as a Universal Crossover, but the right hand turnout crossover overlays and intersects the left hand crossover.

Deadhead trains operate without passengers (out of service). Deadhead trains are typically used to move trains from yards to the start of service, to yards at the end of service, or to remove trains from service for scheduled or unscheduled reasons.

Fixed-block signal system is a signaling system that divides each track into different fixed-length blocks with a signal at the entrance to the block to govern whether it is safe to enter and occupy that block. This type of signaling system is the most prevalent type within the NYCT subway.

Layup refers to a revenue train exiting revenue service.

Line refers to the name of the infrastructure (e.g., Brighton Line).

Put-Ins refers to a non-revenue train entering revenue service.

Relaying trains is the repositioning and reversing of an out-of-service train from one subway track to another, usually to position it for another revenue trip.

Revenue train is a train that is in passenger service.

Storage yard is a place where trains are stored either during the middays and/or overnight hours.

Tail tracks are non-revenue (no passengers allowed) tracks where subway trains are either stored or turned back.

Turnback is when a train changes the direction of travel, such as when a southbound train becomes a northbound train.

Turnout is a special track installation used to allow trains to proceed straight ahead or to diverge to another track. # XX turnout is the classification of a turnout by the inclination of the rail crossing contained in the

turnout. Higher turnout numbers correspond to lower crossing angles and hence higher permissible speeds over that turnout. For example, a # 10 turnout will permit trains to operate at a faster speed than a # 6 turnout. Higher turnout numbers also correspond to longer turnout footprint length. A #10 turnout occupies a longer footprint than a # 6 turnout.

Turnout Tangential Geometry is a detailed design improvement to the geometry of the curved rails in a turnout switch that reduces the rate of change of lateral acceleration (aka jerk) as a train makes a diverging move on the turnout. This allows trains to diverge at higher speeds compared to a conventional turnout, without increasing passenger discomfort or the risk of derailment.

Appendix B – Construction Duration and Capital Cost Estimate